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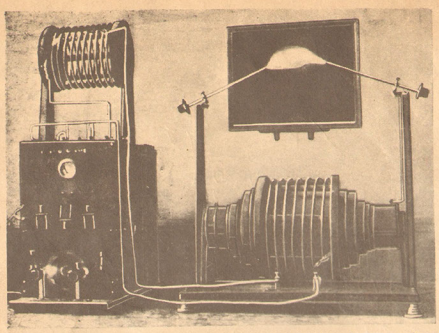
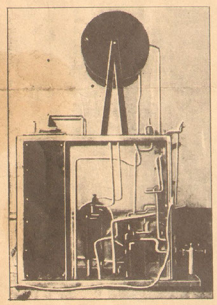
High-Frequency Apparatus

Building an Oudin coil, a Tesla coil, and how to construct a control board for the same, containing all equipment needed for proper operation

by Ludwig Depose



A nine-inch spark from the Tesla, the construction of which is described; input, ¼-K.W. transformer.



Side view, showing the location of most of the apparatus.

● IN the following article is given a complete description for the making of high-frequency apparatus which, with an input from a ¼-K. W. transformer having an 8,000-volt secondary, will produce a spark 9 inches long from the secondary of the Tesla coil, and with a ½-K. W. transformer (such as may be obtained from a neon lighting outfit) having a secondary with four taps of 5,000, 8,000, 12,000 and 15,000 volts, will deliver an 18-inch spark.

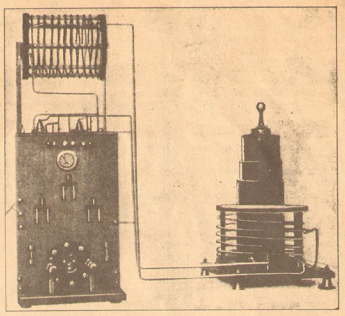
With such a coil, all the familiar Tesla experiments can be carried out and the gas X-ray tubes can be made to operate.

The current from the Oudin coil is absolutely harmless and may be taken into the body, even though the voltage may be in the neighborhood of 500,000 volts; the frequency is so high that the current does not penetrate deeply, but merely runs along the skin surface. It is always advisable, when passing the spark through the body, that a small piece of metal, such as a metal rod, be clasped in the hand, and that this be approached to the ball on top of the Oudin; otherwise the heat of the spark may produce a "shock" sensation. It is also always advisable, when operating the Oudin, to connect the ground lead to a suitable ground and so protect transformer windings. For further protection of line wires and meter, a kick-back preventer has already been wired into the circuit.

The control board for the high-frequency apparatus permits connecting either the Oudin coil or Tesla coil to the same; and it confines the necessary material for excitation of the coils into one compact place, instead of having them scattered all over the table. The connections go directly to a connecting block. The baseboard of the control equipment is a piece of hardwood (formerly an old table top), which was cut to 14½"x25" and beveled; then four rubber feet were set under the bottom. A piece of ¼" veneer from an old closet door was cut to 14"x18" for the panel, and given two coats of varnish; then bracketed to the base. The 150-volt A. C. voltmeter is optional and need not be added.

While a fan motor can be used to operate the rotary spark gap, in this construction a vacuum cleaner motor was employed. The rotor of the rotary spark gap is cut from a sheet of bakelite and is 5" in diameter; eight holes are drilled for the contacts, which are of zinc, made from a zinc rod ½" in diameter. One side of each piece is drilled and tapped for an 8/32 screw. The zinc contacts are then fastened to the disc of bakelite with round 8/32 screws, and a piece of wire is soldered to each connecting all the contacts together. For the other side of the rotary gap, two square rods ½"x½"x5" long were drilled through the side 1" from the top and tapped to pass an 8/32 brass screw, 4" long. A zinc contact is screwed to one end of the 4" screw, and the other end is fitted with a hard rubber binding post. The square rods are mounted vertically in front of the disc (directly in line with the contacts) to two pieces of zinc, and these zinc strips in turn are connected to two wires which pass through the board. The disc itself is fastened to a pulley which in turn is fixed to the motor shaft with the set screw.

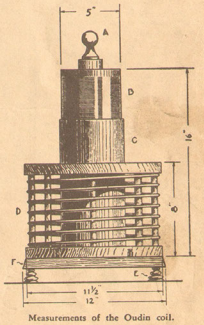
The safety gap consists of two brass binding posts, two 8/32 screws 3" long (with the heads cut off), two zinc contacts made as described before and two hard-rubber binding posts. The space, when the gap is set for a ¼-K. W. transformer, is ⅜". The three switches found on the panel were taken from their porcelain bases and for fuses, two 30-ampere cartridges were employed, clips for the same also being removed from the porcelain bases.



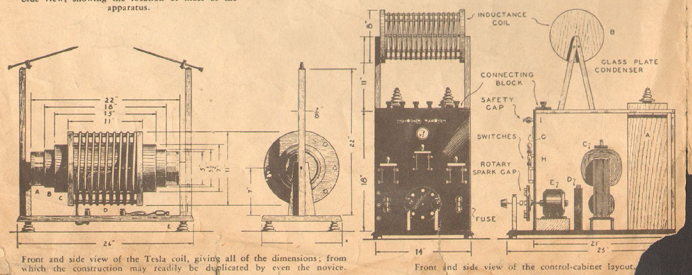
How the Oudin coil is connected to the control board.

The inductance coil was built up on circular pieces of wood ⅞" thick, 8" in diameter. Eight holes were drilled halfway through each piece to receive ⅝" dowels, which were set into place with waterproof glue. The dowels were marked by first winding a piece of string around them, then notching with a rat-tail file; they were wound with ¼" soft-copper tubing, pulled tightly so that it cannot slip out of the spacing notches. A small battery clip is fastened to a 12" length of flexible copper wire, to change the inductance by altering the number of turns in the circuit. For a kick-back preventer, two ordinary telephone condensers, with capacity of 2 mf. each, are connected in series across the line, and the center point is connected to the ground.

The connecting block is a piece of bakelite 14"x3" containing six binding posts; this is fastened on the top front end of the frame with brass angles. For the large condenser, 18 glass plates 9½"x14½"x1/16" are acquired, and 17 copper sheets, 24 gauge, cut to the size indicated. Both sides of the glass plates are cov-

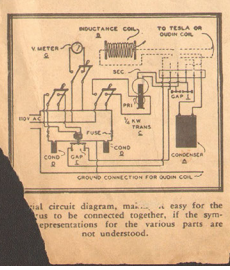


Measurements of the Oudin coil.



Front and side view of the Tesla coil, giving all of the dimensions; from which the construction may readily be duplicated by even the novice.

Front and side view of the control-cabinet layout.



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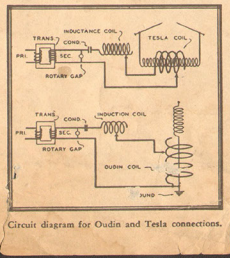
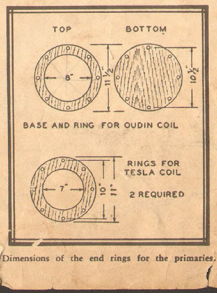


Circuit diagram for Oudin and Tesla connections.



Dimensions of the end rings for the primaries.

Tesla Coil

ered with varnish, and the copper sheets are put in between with the lugs brought out alternately; first to the right, then to the left. The lugs may be soldered together and are then connected by means of a small piece of wire with posts in the top of two stand-off insulators, fastened to the top of the condenser case. A ½" space is left all around the plates, in the building of this case, and the space is filled with melted beeswax.

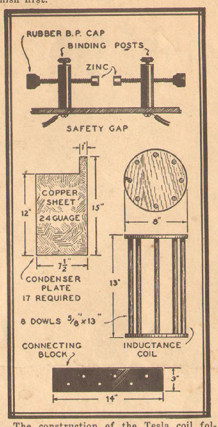
The uprights holding the inductance coil are four pieces of wood ⅜"x⅞"x11" long. They form an inverted V and are fastened to the center of the circular pieces, preferably with dowels; although wood-screws could be used in this position.

The base of the Oudin coil was cut from the same table top and measures 12"x14". Two binding posts are mounted on the front. The primary consists of ¼" copper tubing, wound on a drum of the dimensions given in the diagram.

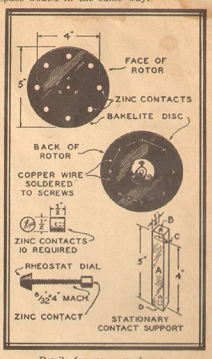
Here again, ⅜" holes are drilled to take the vertical dowels. The secondary is a bakelite tube ¾" in diameter, although a pasteboard mailing tube could be used after being treated with two or three coats of shellac. No. 30 double-cotton-covered wire was used in winding the secondary, and a string of the same diameter was wound on at the same time, in this way, separating the wire by its own thickness. The winding was done by hand, one person rotating the cylinder while another did the winding. In order to keep the wire in place, the top was given a coat of varnish first and, when it was tacky, the winding was started. After the coil was completely wound, the string between the turns was removed and the coil was given three coats of varnish. The bottom of the tube was fitted with a round block, fastened on the inside, and a hole was then drilled through this to pass the wire connection which attaches to the left binding post. A clip is connected to the right post.

Details for construction of inductance coils, copper sheets for condenser, and safety gap.

In the top of the secondary tube another block was fastened, another long machine screw passed through it. The wire from the top of the secondary is connected to the brass ball, (obtained from an old ornamental iron gate or a bed post). Four stand-off insulators were fastened to the bottom of the base. The secondary is covered with a heavy insulating paper layer ¼" thick, although heavy wrapping paper may be substituted, if given a coat of varnish first.



The construction of the Tesla coil follows in general the construction of the Oudin coil. It will, however, be seen that the primary is in the center; that it does not connect with the secondary; and that two rods ¼" thick, filed to a point form the spark gap. The wire on the secondary is the same as in the Oudin, and is space-wound in the same way.



Details for rotary spark gap.

It should be remembered by the builder that, wherever possible, wooden dowels should be used in the construction, particularly for fastening the round discs of wood into the secondaries of the coils and that, wherever possible, no metal parts should enter the construction other than those distinctly specified. In this way, it will be made quite unlikely that a spark will fly from the secondary to any of metal screws or other pieces; and all the current will be effective at the gap. It is also advisable to give the article at least three coats of varnish after it is finished, wood and all, but not over the primary copper tube.